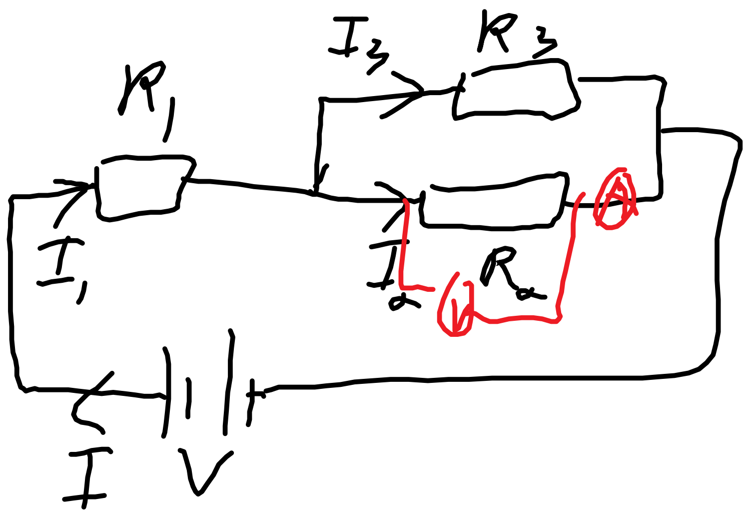


eg. set $R_1 = 50\Omega$, $R_2 = 100\Omega$ and $R_3 = 200\Omega$ and $V = 6.0$ V.

a) in the circuit diagram, show the placement of the voltmeter and ammeter to measure the voltage across and current through R_2.

a) What is the equivalent resistance of the parallel portion of the circuit?

1/Rt= 1/R2 + 1/R3

1/Rt = 1/100 + 1/200

1/Rt = 2/200 + 1/200 = 3/200

Rt = 200/3=66.7 Ω

a) What is the equivalent resistance of the whole circuit?

$Rt = R1 + RII = 50+66.67=116.67 = 117\Omega$

b) What is the current out of the battery?

$I = V/R = 6/116.67=0.0514 = 51.4$ mA

a) What is the voltage drop across R_1?

$V_1 = I_1R_1 = 0.0514x50=2.57$ V

a) What is the reading on the ammeter and voltmeter for R_2?

$V= V_1+V_{2or3}$

$V_2 = V-V_1 = 6-2.57=3.43$ V

$I_2 = V_2/R_2 = 3.43/100=0.0343$ mA

or $I_2/(I-I_2) = R_3/R_2$

a) Which resistor dissipates the most power? Guess and calculate.

$P=IV=I^2R= V^2/R$

$P_1 = 0.0514$^2x50=0.1321 W

$P_2 = V^2/R = 3.43$^2/100=0.1176 W

$P_3 = V^2/R = 3.43$^2/200=0.0588 W

so R1 dissipates the most energy

p500 Q 5, 7, 9, 13, 15, keen 19, 25

Internal Resistance, r and meter resistance

When you have a battery and lots of current flows out of it, what do you notice? It gets really hot, or when you charge the battery it gets hot.

The energy transfer in the battery is not perfectly efficient. We model this lack of perfection as being like a resistor inside the battery (not a real resistor).

superconduction - conducts electrical current with no energy loss. Not infinite current because of the internal resistance of the power supply and the rate of the chemical reaction.

eg. you connect a 6.0 V battery to a light bulb with 10Ω of resistance. You measure the current with a perfect ammeter and get 0.50A. What's the deal?
Assuming all the lost voltage goes to the internal resistance of the power supply, r, determine

a) the terminal voltage of the battery (external circuit)
V=IR = 0.5x10=5.0V
so the battery has 6.0V reading when not connected to the circuit. Let's call that the emf
emf is voltage with no current

b) the internal resistance r

emf - Vterminal = Ir

6-5 = 0.5xr

r = 1/0.5=2.0Ω of internal resistance

IB data booklet $\varepsilon = I(R+r)$ - not valid for charging the battery

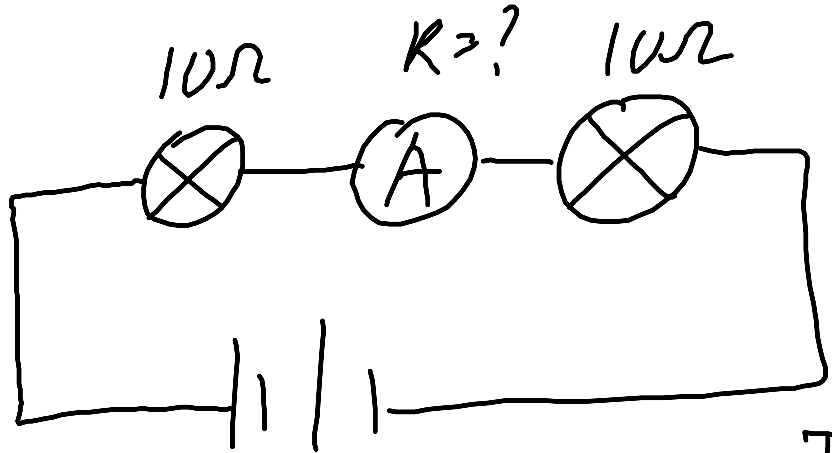
ε is emf

I is current out/in of the battery or power supply

R is the resistance of the external circuit

r is the internal resistance

You have two light bulbs in series and they light up. You connect an ammeter, and they don't light anymore when it reads 240 mA. You switch the ammeter and get 500 mA and the lights light up. What is the resistance of the two ammeters? (assume battery has terminal voltage of 7.0V and the bulbs have 10Ω of resistance) What's the deal?



$$7.0V = I(R_1 + R_2 + R_3)$$

$$7.0V = 0.24(10+10) + 0.24R$$

$$-4.8$$

$$\overline{\quad} 2.2 = 0.24R$$

R = 2.2/0.24=9.1667 9.2Ω

(7-(0.5x20))/0.5=-6 assumed resistances are messed up, you can't have negative resistance - battery

When I measured more carefully, the resistance of the first ammeter was 23Ω and the second was 1Ω